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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Sri Lanka, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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# The Cattle Challenge: Controling Backyard Pollution in North Vietnam

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As anyone who has stood in a field of cows will tell you, cattle manure can be a particularly unpleasant pollution problem. In many countries across Southeast Asia, it has become a significant environmental challenge because cattle are being reared in ever-larger numbers close to human habitation. →

**A summary of EEPSEA Research Report 2005-RR6, *Dairy Cattle Development: Environmental Consequences and Pollution Control Options in Hanoi Province, North Vietnam* by Nguyen Quoc Chinh. The Faculty of Economics and Rural Development, Hanoi Agricultural University, Hanoi, Vietnam. (Contact : nqchinh@yahoo.com)**

# "Small-scale biogas digesters offer an...

In an effort to improve the situation, a new study from Vietnam has looked at several pollution control options available to farmers. It finds that pollution caused by cattle husbandry is having a significant impact on the environment and on people's quality of life. Encouragingly, it also finds that small-scale biogas digesters offer an appropriate and practical solution to the problem. It therefore recommends that the Vietnamese Government provides technical and financial support - backed up with education and awareness campaigns - to encourage the development of biogas digesters of an appropriate scale and technological sophistication at the family and commune level.

## More Milk Equals More Manure

Dairy cattle farming had grown rapidly in Vietnam, because demand for milk is increasing, especially in urban areas. Cattle raising is profitable and has attracted many small farmers in recent years. Unfortunately, many of them do not have the resources to adequately manage the pollution their cows and other livestock produce. Many farmers simply use their compounds as a waste dump for cattle manure. This creates air and water pollution and, in turn, causes health problems for both cows and people.

The study was carried out by Nguyen Quoc Chinh from the Faculty of Economics and Rural Development at Hanoi Agricultural University. He focused on the Gia Lam district in the suburban areas of Hanoi, where dairy cattle rearing is becoming a key economic activity. Three communes were chosen for the study: Phu Dong, Trung Mau, and Duong Ha. There were over 4,800 small farm households in the study site. Almost 500 of these households raise cattle, with an average of two cows per household.

## Assessing The Options

Several pollution control options are already being used by small-scale cattle farmers in Gia Lam. These include (a) the 'traditional' or 'base case' method, in which cattle waste is deposited in a hole in the ground; (b) large and small-scale biogas digesters, in which microorganisms turn excrement into biogas (methane gas, which can be used as fuel and organic fertilizer); and (c) having manure taken away by a contractor. Each option has advantages and disadvantages. Chinh aimed to investigate the actual environmental impact of cattle pollution and then determine which clean-up technology was best in terms of effectiveness, practicality and cost.

To see how the waste treatment options performed, information was gathered on how difficult each was to install and operate; how effective each was and how much each cost to install and operate. Data was also gathered on the economic and environmental benefits each brought.

To get the necessary information, three different types of households were interviewed: cattle-raising households that had installed biogas digesters; cattle-raising households that had not installed the digesters; and households that did not have any cattle but were directly affected by dairy farms nearby. In all, 32 households were interviewed – roughly equal numbers from each 'type'.

Householders were asked how pollution caused by cattle affected them including their perceptions of bad smells, well water pollution and how often they had to visit the doctor.

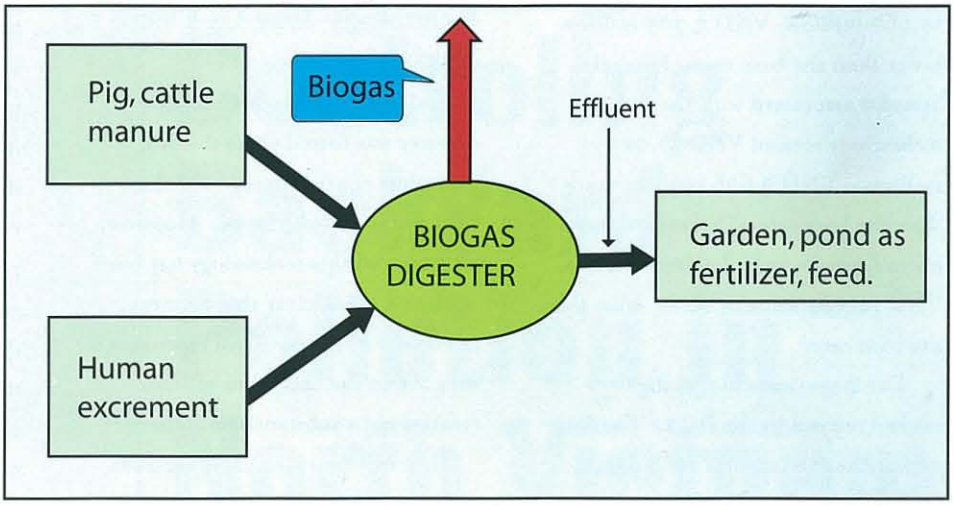
***NPV of incremental benefits and ranking of alternative treatment options***

| Pollution control option | NPV of net incremental benefits (VND) | BCA | Ranking | | |
|---|---|---|---|---|---|
| | | | *Economic* | *Environment* | *Practical feasibility* |
| Base case | - | 4.68 | 3 | 4 | 1 |
| Small biogas digester | 12,343,584,409.3 | 6.21 | 1 | 1 | 3 |
| Large biogas digester | 7,536,693,617.2 | 5.93 | 2 | 2 | 4 |
| Waste removal by middlemen | -3,241,532,473.0 | 3.73 | 4 | 2 | 2 |

*appropriate and practical solution."*

There were not sufficient resources to do an in-depth environmental impact assessment for each technology option, so differences in the value of the properties owned by each survey household was assessed as an indicator of environmental quality. This was done on the assumption that people would be willing to pay more to live somewhere where there was less pollution.

**Figure 11. Biogas digester treatment option in Hanoi**




## Pollution And Property Prices

Not surprisingly, people who did not rear cattle reported that nearby cattle farms (especially those without biogas digesters) were responsible for high levels of pollution and caused many health problems – all complained of bad smells, water pollution, and headaches. Again, not surprisingly, cattle-raising households also complained about pollution problems from their own livestock, but perceived these problems as being less intense than did their non-cattle-raising neighbours. Of particular interest was the finding that households that had installed biogas digesters noticed significant improvements in the condition of their immediate environment following the implementation of the technology. They reported that there had been improvements in air and water quality and that health problems had been reduced.

These subjective findings were backed up by the results from the property price assessment. In comparison to the "base case" manure disposal method, adoption of all the other options translated into higher property prices for the farmers concerned. The financial improvements ranged from a minimum of 2% for large biogas digesters and waste removal by middlemen to a maximum of 4.5% for small biogas digesters.

## Technology Details

All of the small-scale biogas digesters in use in the survey households were fixed-dome types. These ranged in size from 7-8m3 and cost, on average, VND 4.31 million to construct. Other costs associated with this technology, included labour, water and the chemicals used to encourage the development of micro-organisms. The benefits the digesters brought included the value of the compost they produced and the value of the gas they generated.

Only one large, commune-scale biogas digester was found in the study area. However, it did not operate well, since it could not obtain a reliable supply of manure. To investigate this option a large-scale digester in South Vietnam was assessed and the costs and benefits adjusted to prices in the North.

It was found that most of the dairy cattle households that had not installed biogas digesters had extra manure that they had to dispose of. The majority paid manure collectors to collect the extra manure, which was then sold as fertilizer for vegetable production and horticulture.

## Biogas Digesters Come Out Smelling Sweetly

All the different waste treatment approaches were compared against the base case or traditional method. This was first done over a time period of 15

years – the typical lifespan of a biogas digester. Based on a benefit-cost analysis (BCA), the installation of the small-scale biogas digester was found to be the best option in terms of economic efficiency. It cost VND 14,667 million, VND 2,707 million lower than the base case. Financial benefits associated with the digester technology totaled VND 91,025 million – VND 9,636 million more than the base case. This meant that, overall, small-scale digesters were VND 12,344 million better value than the base case.

The large-scale biogas digester ranked second in the BCA. The base case and waste removal options had the lowest ranking.

When this analysis was repeated, assuming a shorter lifespan for the small-scale biogas digester and a 20% larger initial investment, the small biogas digester still came out on top.

The biogas digester also came out as the preferred option from an environmental perspective. The base case came out worst.

The base case only scored highly from a practical point of view as it is very simple to operate, requiring little or no initial investment or maintenance. The family-scale biogas digester ranked third in this assessment because it was relatively complicated to install and operate and because of higher initial investment costs.

## Technology Take-Up Needs Help

Overall, the small-scale biogas digester was found to be the best pollution control option for the suburban areas of Hanoi. However, adoption of this technology has been weak and it was clear that farmers need advice, support and resources if they are to use this form of waste treatment in substantial numbers.

The results of the survey showed that farmers have to be relatively wealthy to afford the small-scale biogas digesters. Many farmers also lacked the technical know-how to choose the most appropriate biogas digesters for their circumstances. This points to a need for financial and technical assistance. Chinh therefore recommended that the government should support farmers by extending credit to them at low interest rates and that it should provide subsidies and loans to encourage farmers to install biogas digesters. He also recommended that Vietnam's regional agricultural and forestry extension centers provide technical support and advice to farmers in their areas.

Chinh cautioned that financial and practical support would not, however, be enough and that people need to be convinced that the technology was a 'good thing'. He therefore recommended that demonstrations of biogas digesters be run in rural areas to change the perceptions and practices of the local residents. In particular, he advised that these demonstrations should aim to encourage local people to use compost for crop production instead of chemical fertilizers and untreated manure. He also recommended that they should show farmers that it is safe and effective to use biogas as a cooking fuel. The positive message about biogas digesters and biogas should be widely communicated to farmers through newspapers, radio and TV - to get everyone involved in the process of "cleaning up the cows".

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